

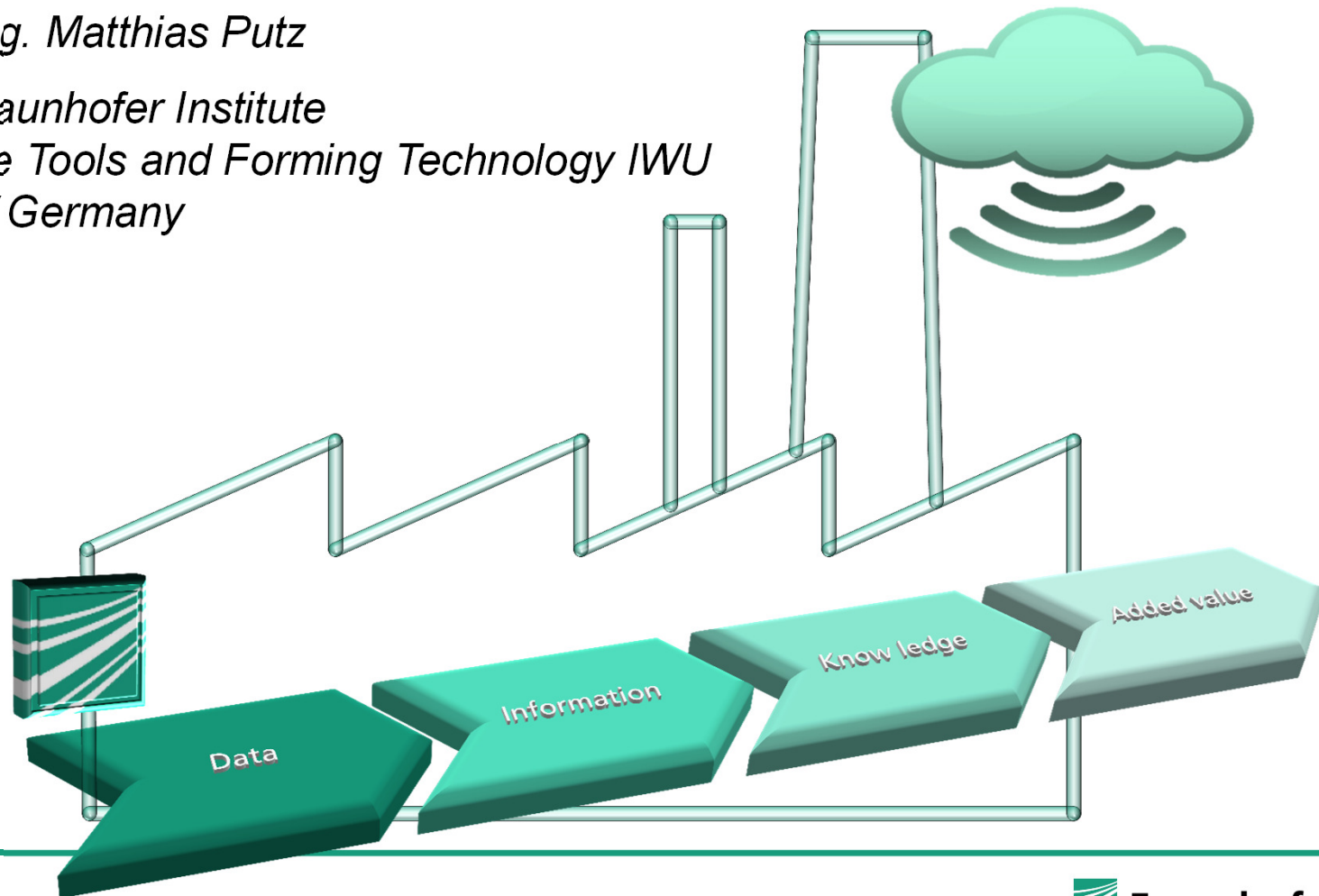
THE E³ RESEARCH FACTORY

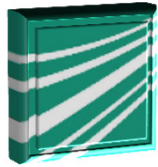


TOWARDS A RESOURCE EFFICIENT PRODUCTION THE NEXT STEP TO REALIZE A GOOD FEELING PRODUCTION

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*Director Fraunhofer Institute
for Machine Tools and Forming Technology IWU
Chemnitz / Germany*





Fraunhofer IWU

Short Profile



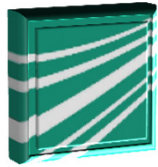
- Start in 1991
- Locations in **Chemnitz**, Dresden, Zittau, Wolfsburg, Leipzig, Augsburg
- Recently about 700 employees (including part-time)
- 39,9 million € R&D volume (in 2016) (~½ by contract from industry)

■ R&D Competence: **RESOURCE EFFICIENT PRODUCTION**

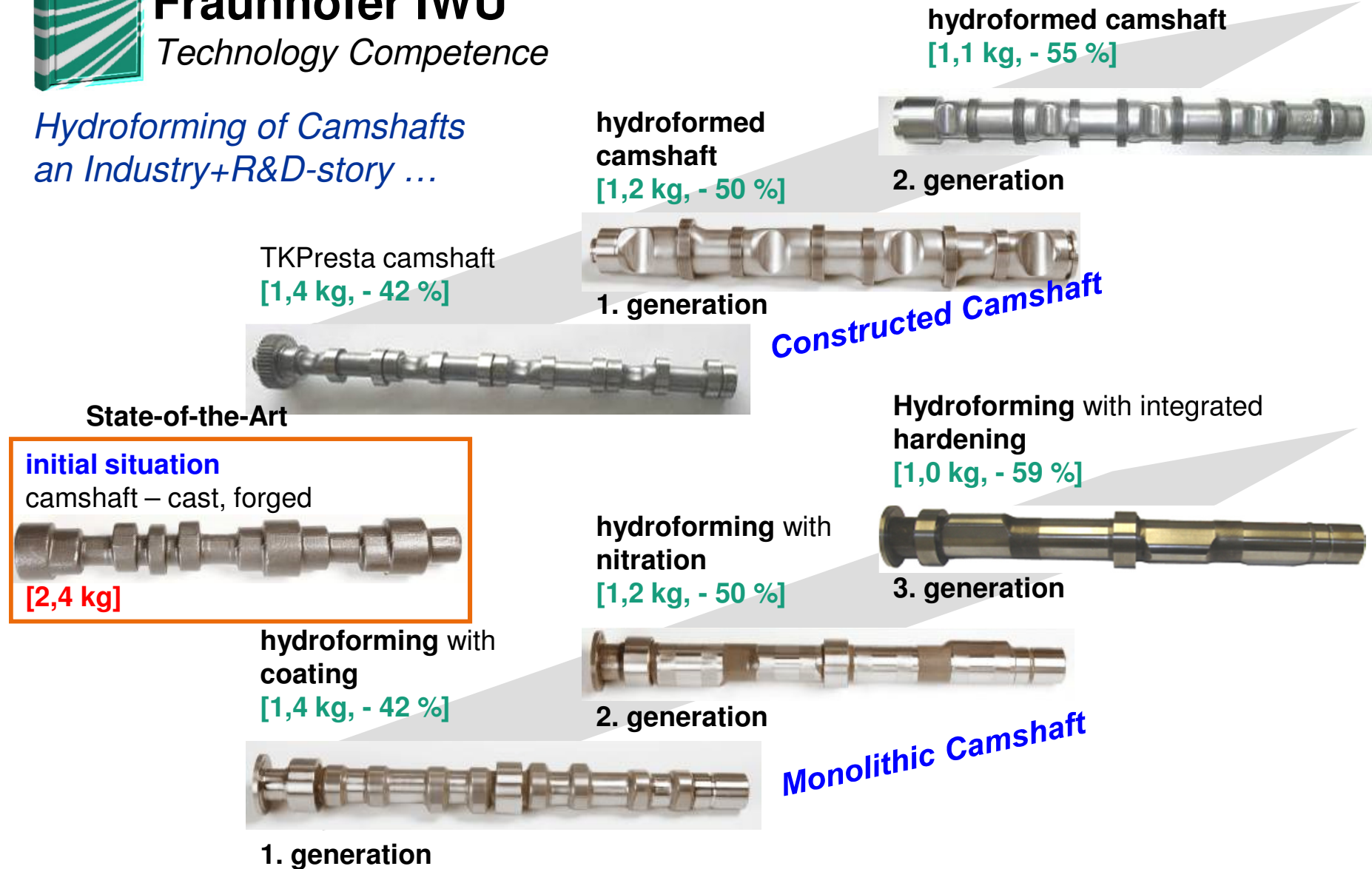
Fields of expertise

- **Machine Tools** and Automation
- Mechatronics and Lightweight Components
- Cutting Technologies
- **Forming** Technologies
- Joining and Assembling
- Production Management





Hydroforming of Camshafts an Industry+R&D-story ...





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Production in Change – the Fraunhofer Concept E³-Production

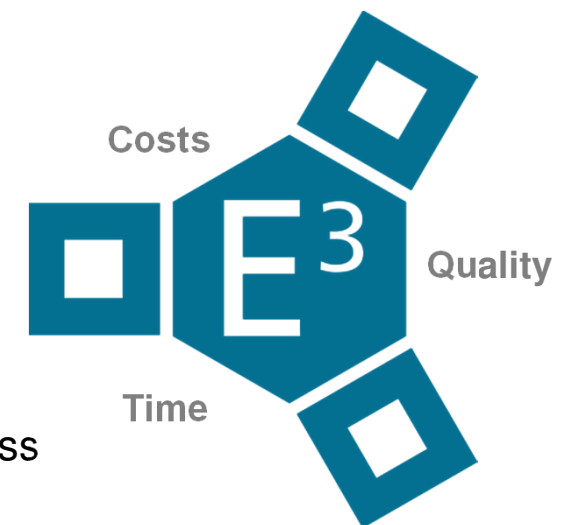
Initiation and implementation a paradigm change in production technology, "maximum profit from minimum capital investment to maximum added value with minimal use of resources."

The E³-Concept of Production

E – like **E**fficient **T**echnology

E – like **E**nergy-adaptive **F**actory

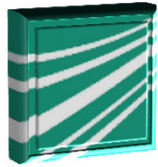
E – like **E**MBEDDING **P**eople for sustainable success



E³ =

consequent Synergy by utilizing all three „E“

- for new **Products**
- in innovative **Business models**



Innovation roadmap since 2013

E³-PRODUKTION



- diversity of basic materials,
- Innovative Technologies,
- Efficient production systems,
- Data as resource

Efficient **P**roduction **T**echnologies

- Modern factories and logistics
- Use of alternative energy sources
- Energy management
- Energy- and resource cycle
- Modern I&K-Technologies

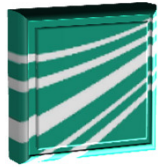
Emission neutral, energy-adaptive **F**actories

Synergies ?!

- **innovation**
- **added value**
- **new products**
- **advantages in competition**

- „human“ as goal and central point of the production
- aging society – production assistance
- Motivation and life reality of the youths
- knowledge and information

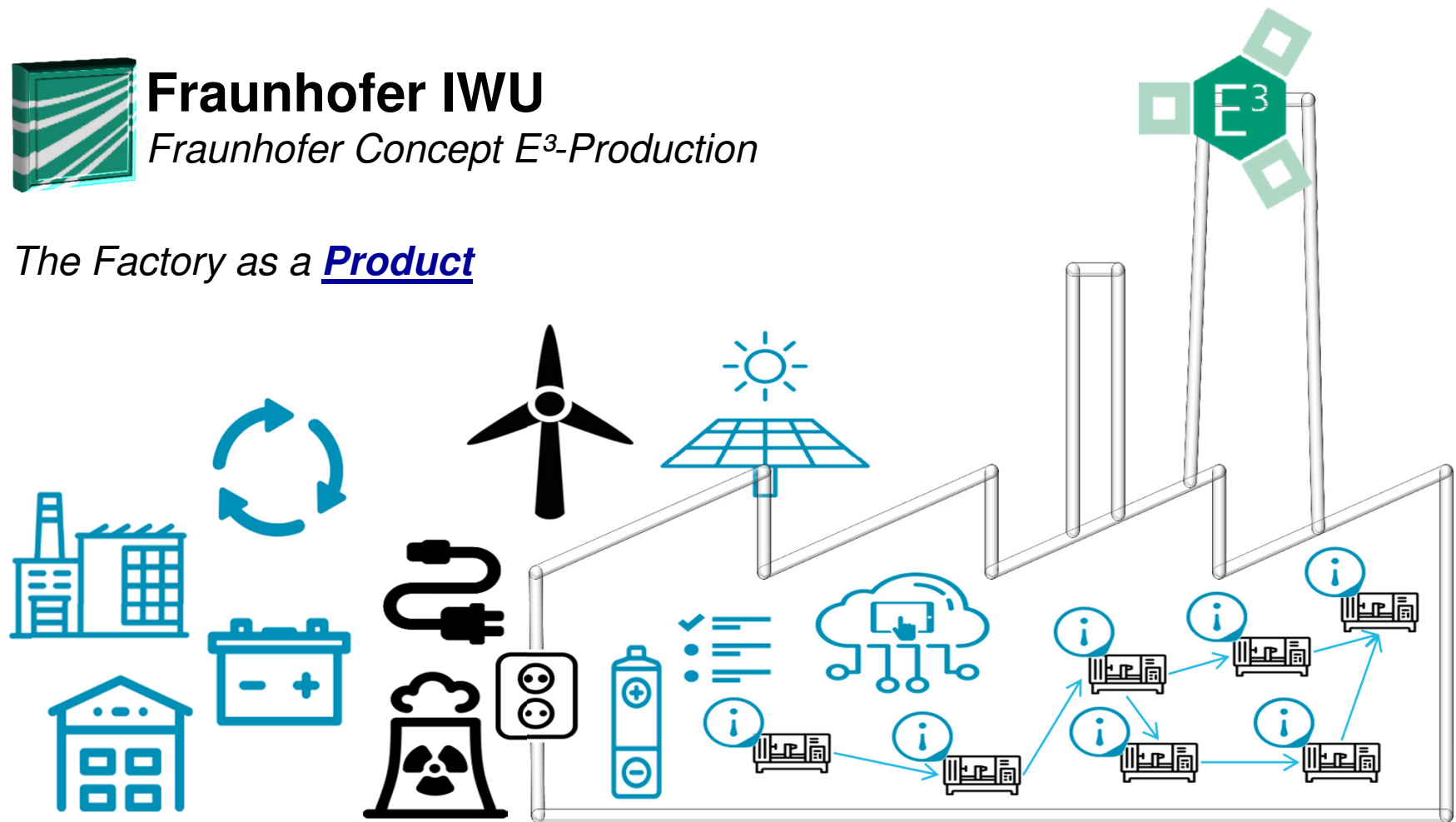
Embeding **P**eople into modern industry concepts



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Fraunhofer Concept E³-Production

The Factory as a Product

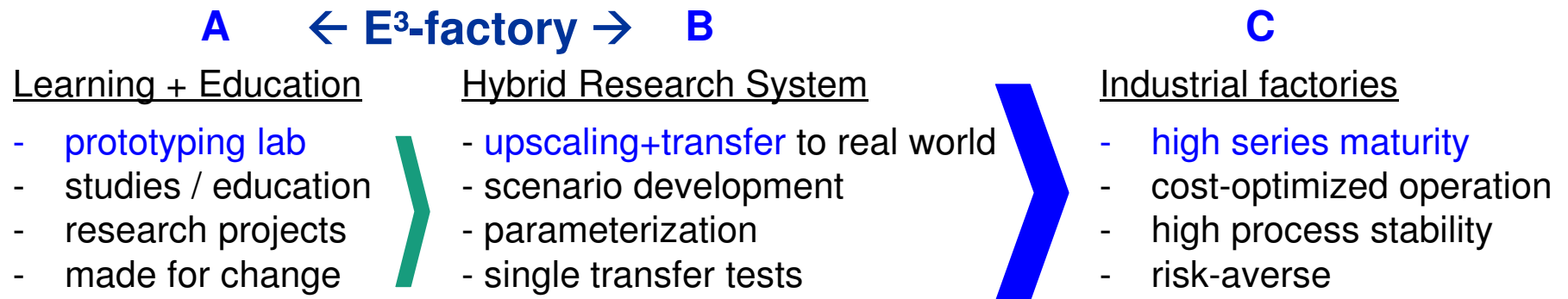
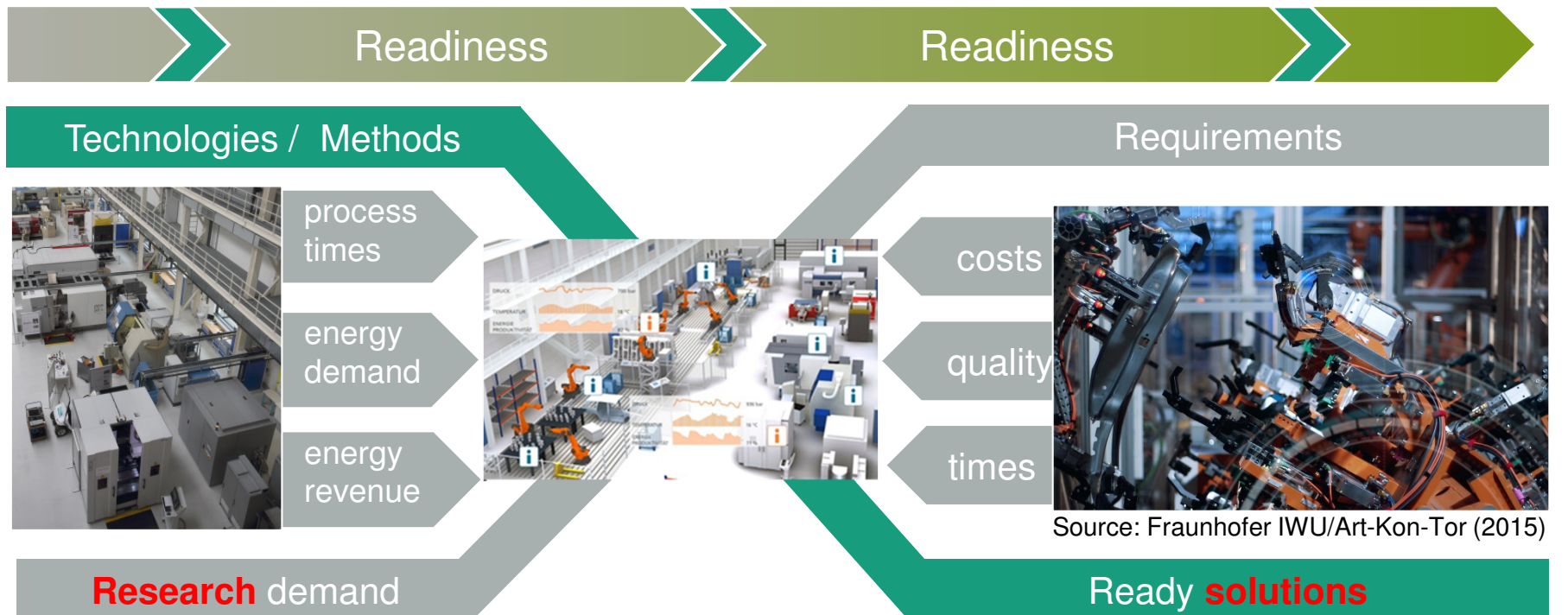


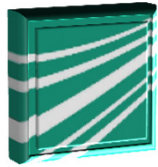
**Manufacturing -
integrativ!**

Manufacturing matters!

**Competitiveness in discrete solutions!
The complexity is growing!**

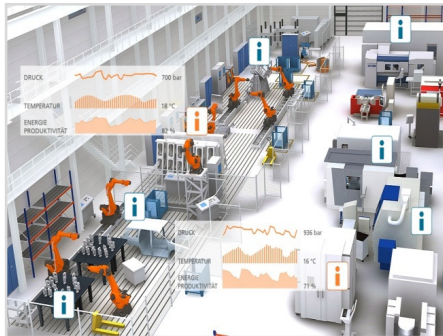
R&D validation and **transfer** strategy – **from lab to industry**





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E³ - Research Factory (opening 04/2014)



■ Next generation of production technique ...

- How we **keep production up-to-date?**
- How we **keep manufacturing in our society?**

■ E³ - production concept: searching synergies

- New technologies and production systems considering **E**nergy- und Resource efficiency
- New production sites and factories acting **E**mission neutral and energy independent
- Overthinking the **E**MBEDDING of people into production in a new way

■ R&D focus in manufacturing:

- Powertrain components
- Body-in-white structures
- Energy and data management



Europa fördert Sachsen.
EFRE
Europäischer Fonds für
regionale Entwicklung

STAAATSMINISTERIUM
FÜR WISSENSCHAFT
UND KUNST

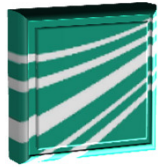


GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

Deutschland
Land der Ideen
Ausgezeichnete Orte 2013/14



Target A: “car body production”

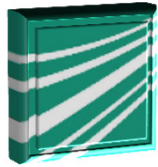
PRODUCTION SYSTEMS OF THE FUTURE

■ FLEXIBLE + INTELLIGENT CAR MANUFACTURING

- Car body production – modular, flexible and cross linked
 - Handling diversity of product variants
 - Fast ramp-up of complex production systems
 - human-machine-cooperation in action



FoFab



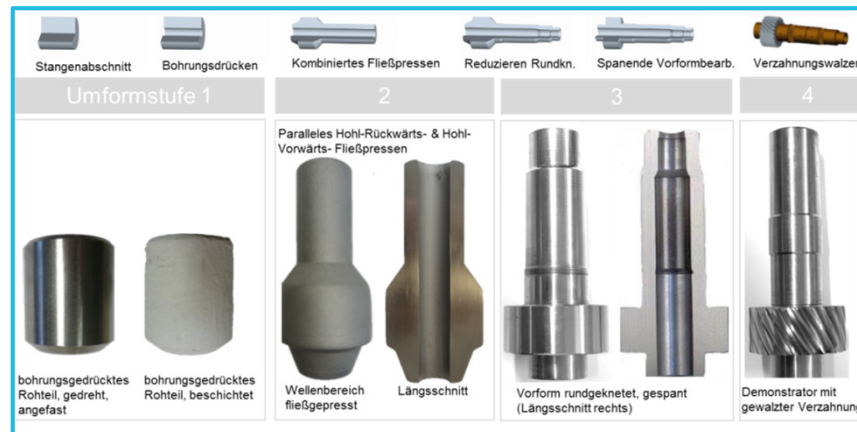
Target B: “powertrain components”

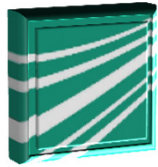
NEW TECHNOLOGIES, NEW PRODUCTS

■ PROCESS-CHAIN POWERTRAIN

■ Ultra-short process-chains

- Forming instead of Cutting?
- Ensuring a significant reduction of material and energy use
- Better product properties and added functionalities?





E³ – Solutions for efficient Technology *Ultrashort process chains*

Forming-based manufacturing toothed gear components

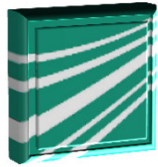
- Continuous consideration of the entire production chain



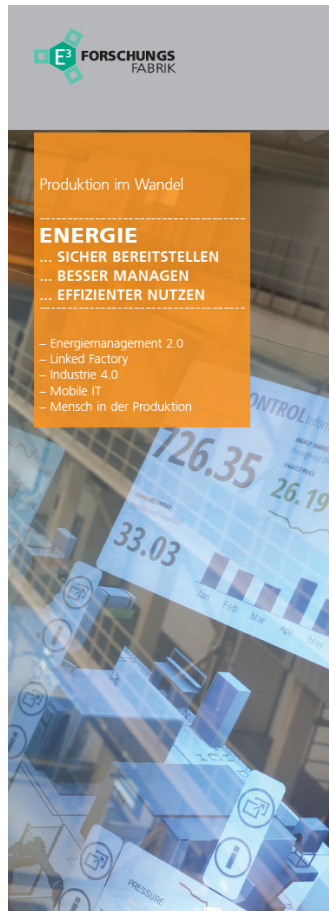
- Reduction of the process chain by three stages
- Reducing the use of materials by 12.5% (0.5 kg per component) and optimizing material utilization by 6.5%



Demonstrator with rolled toothings



Target C: “production in change”



■ **ENERGY AND INFORMATION (DATA)**

... TO BE PROVIDED SAFELY

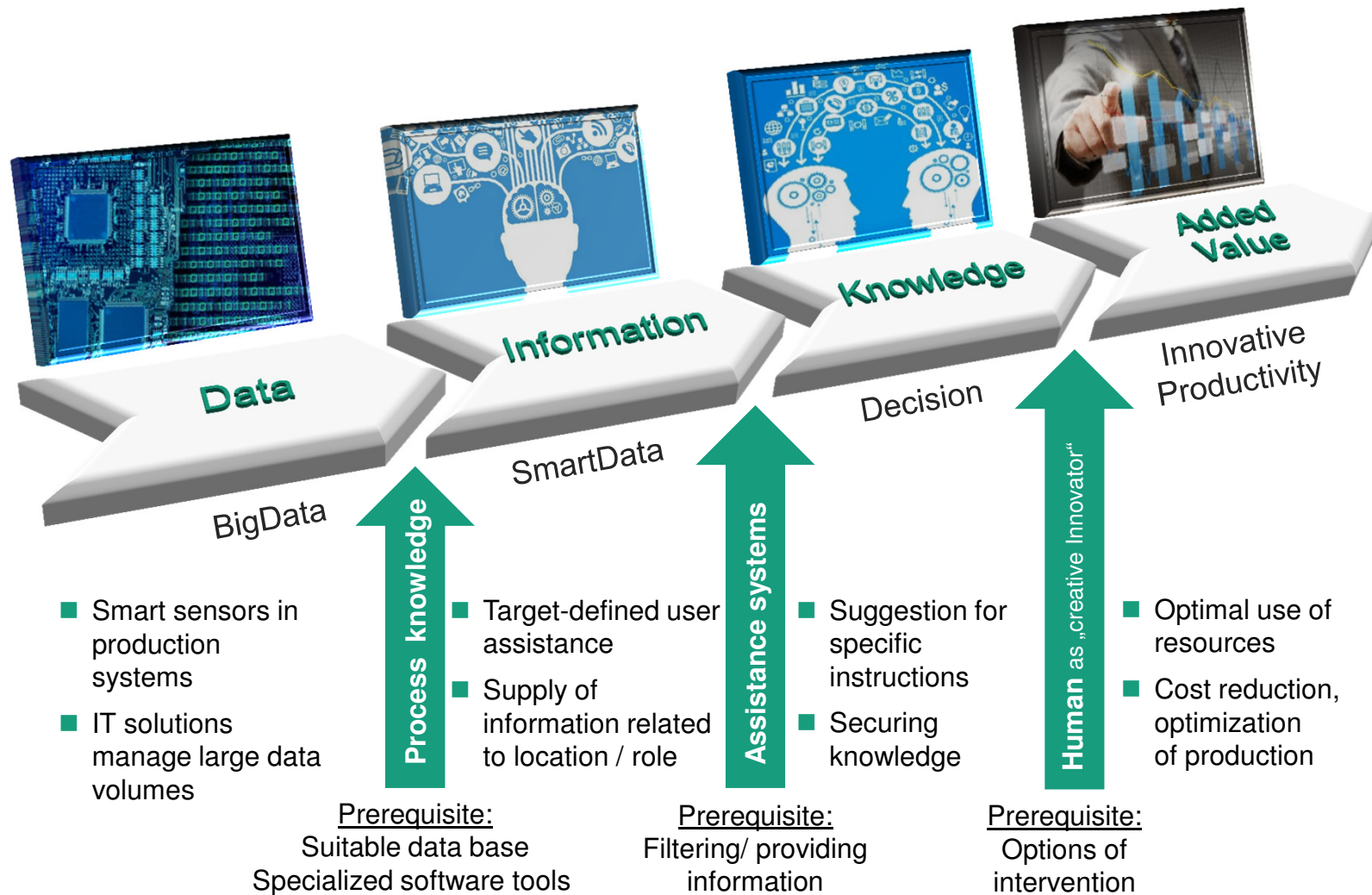
... TO BE BETTER MANAGED AND CONTROLLED

... TO BE MORE EFFICIENT USED

- Energy management 2.0
- “Industrie 4.0” (linked factory + mobile IT)
- Human – a center point of production
→ turning this paradigm into a success story

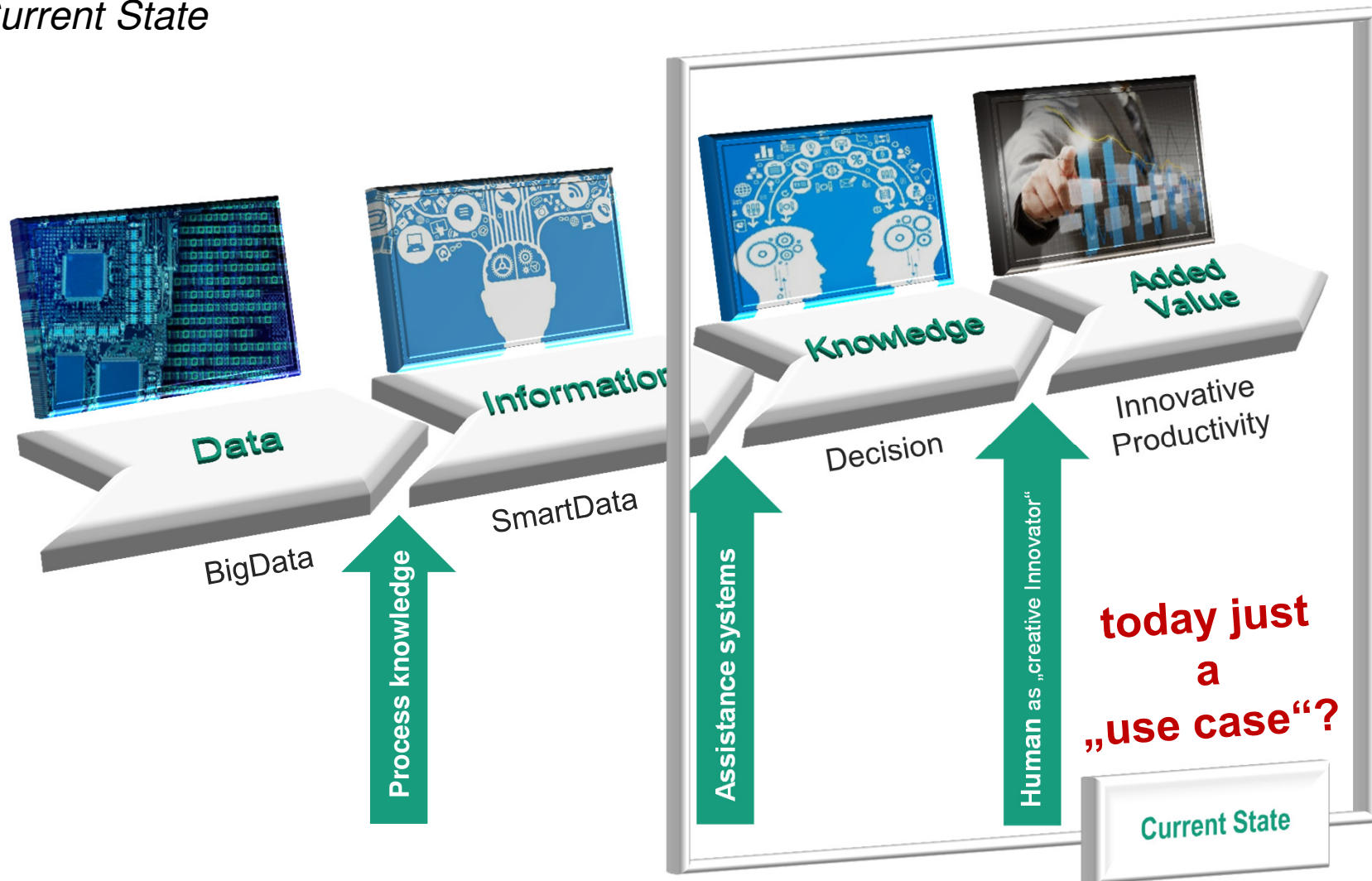
Production Technology in the World of Industrie 4.0

Definition, Workflow and Requirements



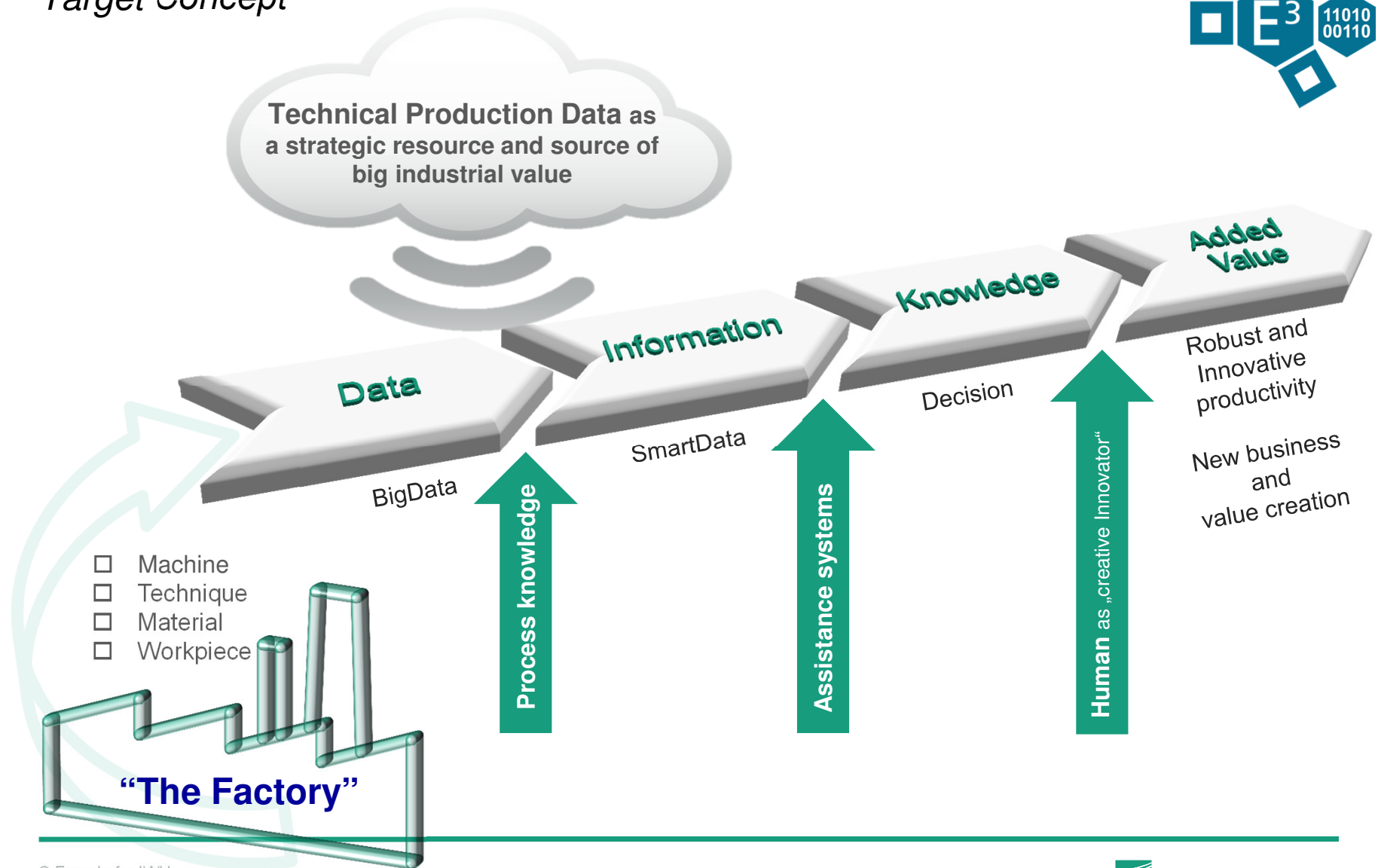
Production Technology in the World of Industrie 4.0

Current State



Production Technology in the World of Industrie 4.0

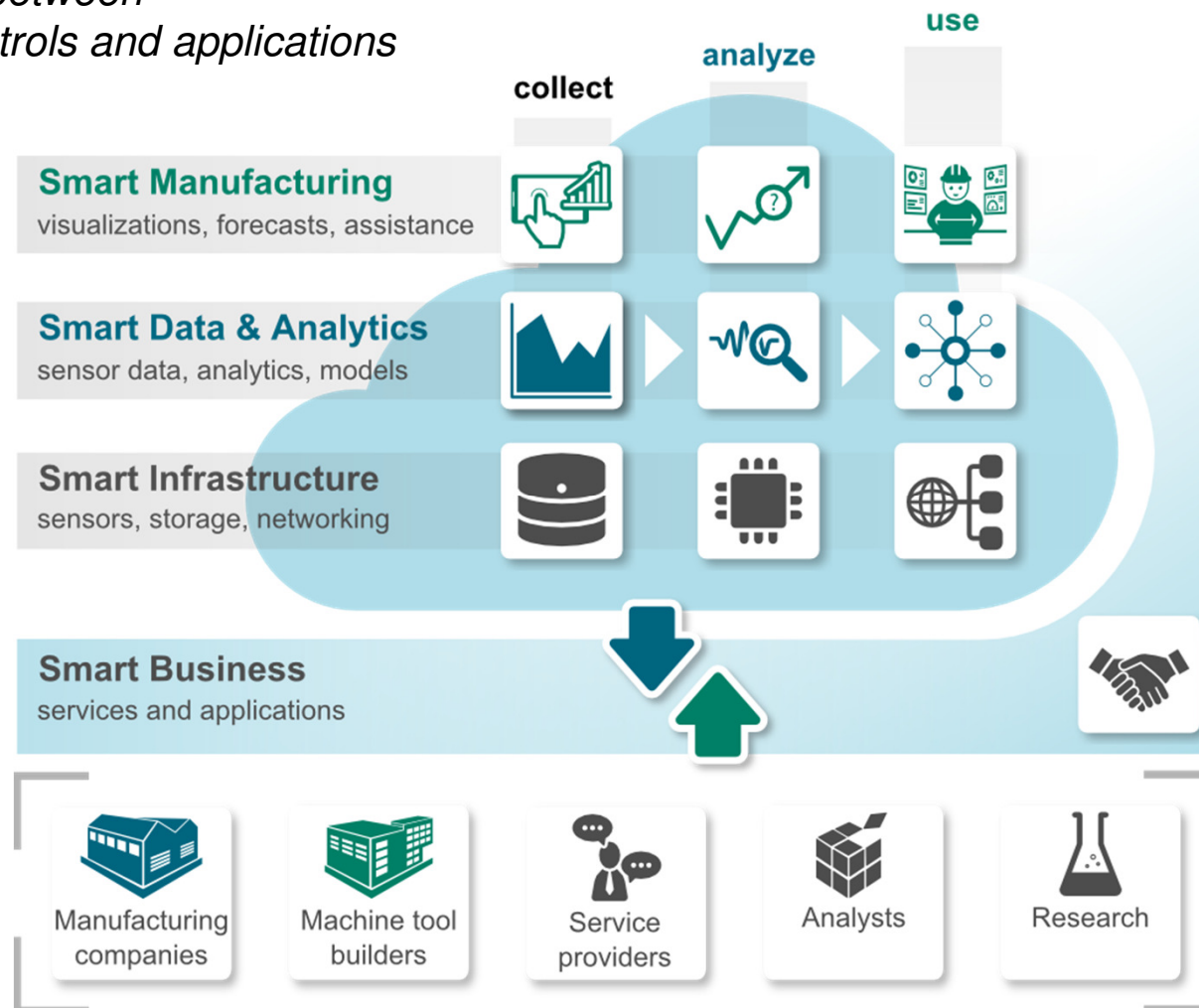
Target Concept



Infrastructure for Using Technical Production Data

Linked Factory - A data hub

*Smart links between
devices, controls and applications*



Infrastructure for Using Technical Production Data

*Smart Components
the Industrie 4.0 - Stacks*



Data-Generating
Ability of machines to
CPPS

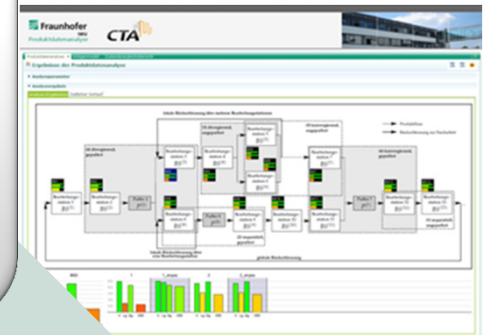
SmartDevices

Components for flexible
connection of data providers,
such as Machines, facilities
and technical building
equipment

Data-Analysing
Use of the available Data

SmartAnalytics

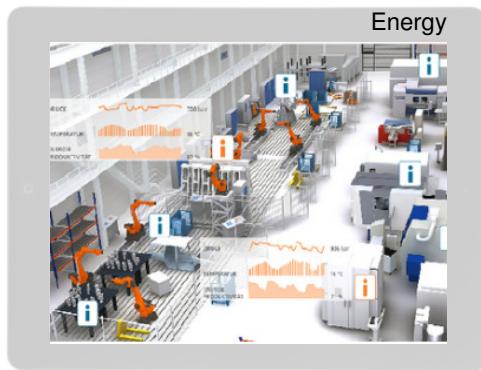
Same data as the basis for
different evaluations (e.g.
Trace4OEE), Productivity
determination by extended
product information



Data-Distribution
Context-based
information delivery

SmartWearables

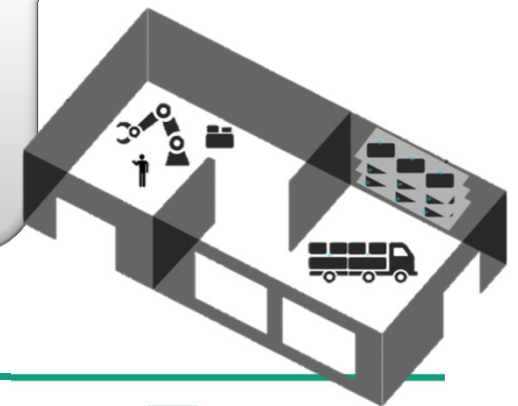
Context-sensitive data and
information provision for
employee integration,
intuitive display for the
production assistance

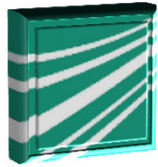


Objects: locating and
identifying

Tracking

Context-based information
generation
Human-Computer Interaction
Monitoring of logistics
processes

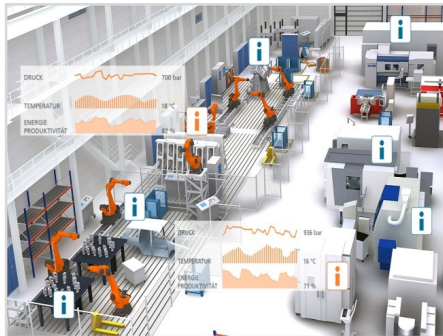
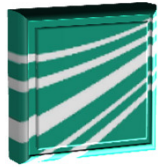




Context-based information providing

- the right Information
- at the right Time
- at the right Place
- to the right Person





■ **Next generation of production technique ...**

- How we **keep production up-to-date?**
- How we **keep manufacturing in our society?**
- How to **keep production competitive?**

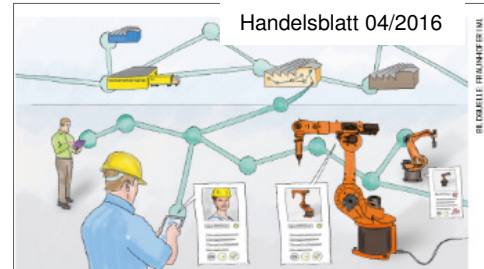
■ **Further development of our R&D focus:**

- Social aspects
- Feeling production
- From data sensing to active data "production"

Production Technology in the World of Industrie 4.0

Integration of Human in the Production

- Social Networked Industry
- Added Value Networks
- Socio Technical Systems
- Fraunhofer E³-concept

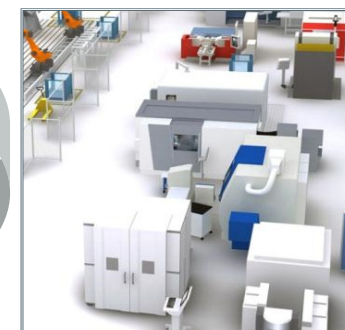


Physical
Reality



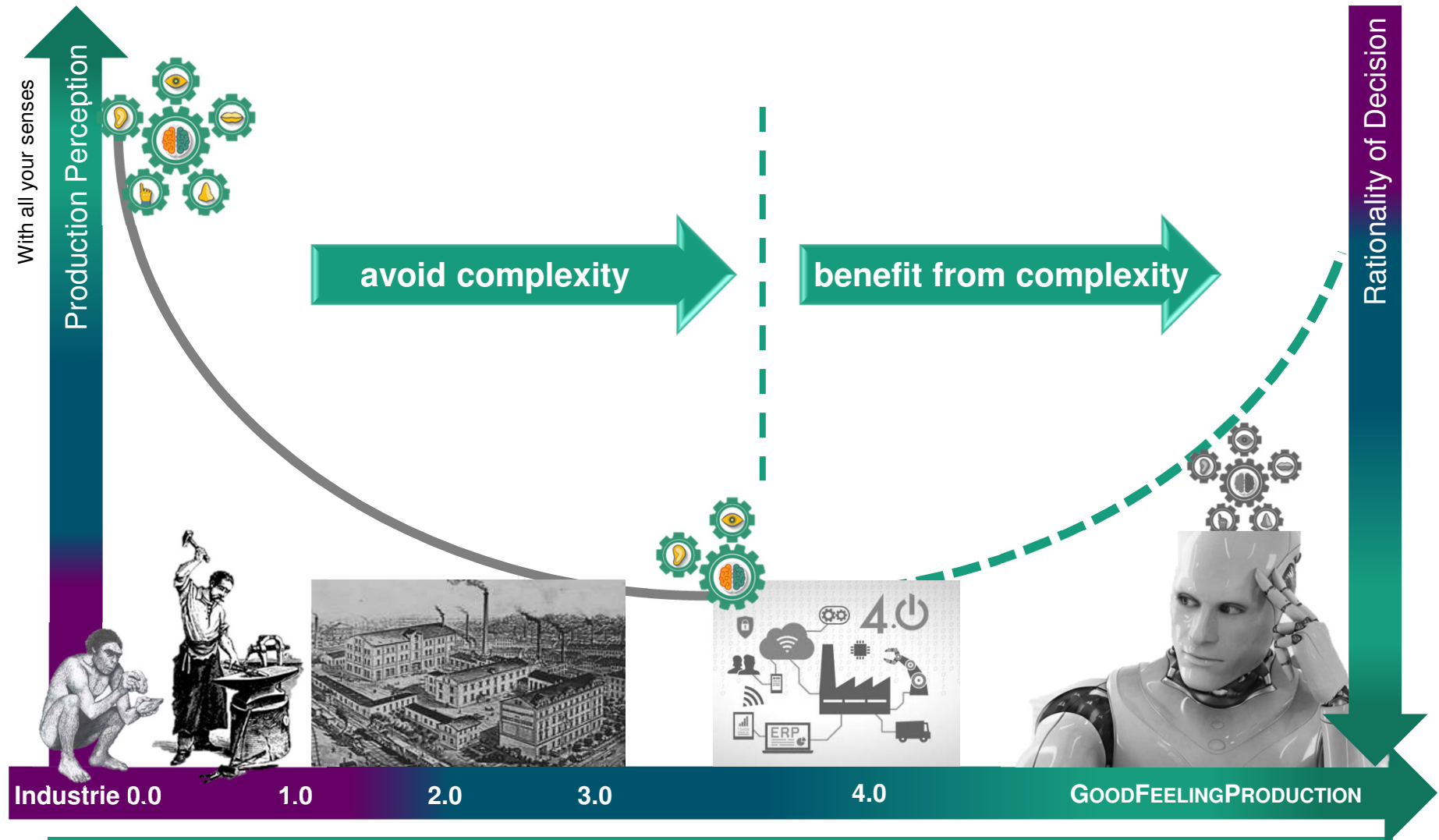
“The Factory”

Cyberspace
„digital twin“



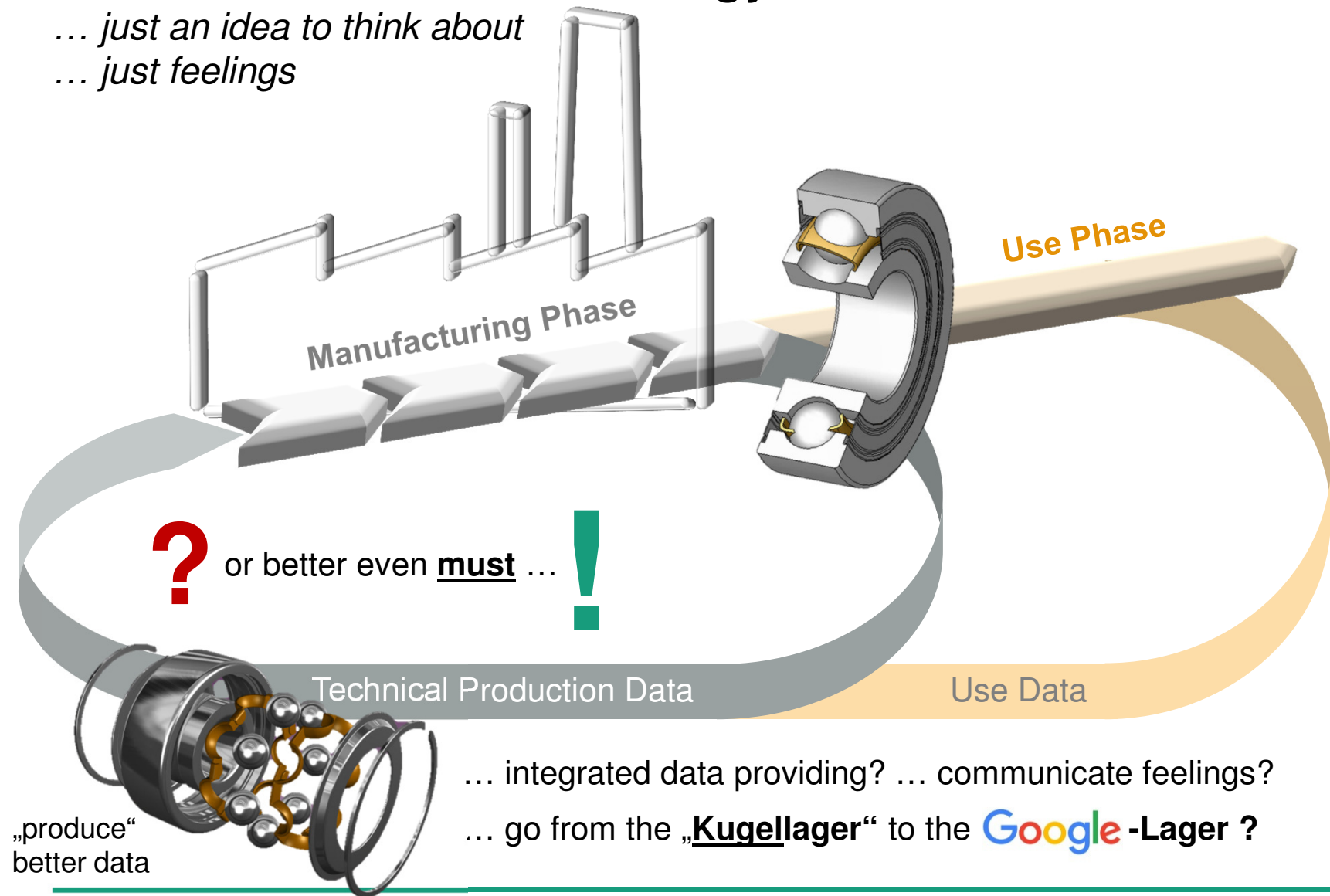
Good Feeling Production

Future and target of sustainable Manufacturing



Future Production Technology vs. Industrie 4.0

... just an idea to think about
... just feelings



JOINT RESEARCH FOR

- Production Technology
- New Products and Business Models
- Employee Qualification



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THANK YOU FOR YOUR ATTENTION!

